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Dolan et al.

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(54) **CHILD RESTRAINT SEAT ANCHORS WITH INTEGRATED CHILD SEAT DETECTORS**

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(73) Assignee: **General Motors Corporation**, Detroit, MI (US)

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(51) **Int. Cl.**
B60N 2/26 (2006.01)

(52) **U.S. Cl.** **297/253**; 280/735

(58) **Field of Classification Search** 297/253; 280/735

See application file for complete search history.

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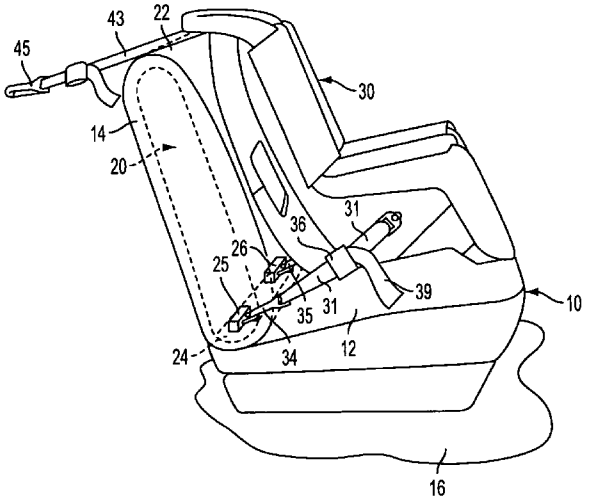
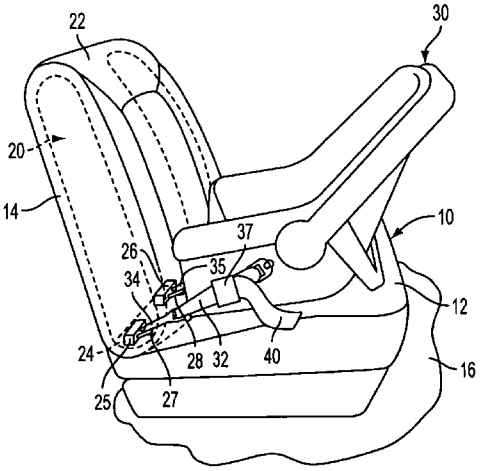
(57) **ABSTRACT**

The presence of a child restraint seat on a vehicle seat is detected by a child restraint seat anchor that is movable from a first position to a second position when a strap from the child restraint seat is coupled to the anchor. In accordance with the preferred embodiment, the movable anchor is slidably mounted in a housing and slides against the bias of at least one spring when the child restraint seat is coupled thereto. A micro switch is activated upon the moveable anchor sliding from the first position to the second position to cause an air bag controller to either deactivate or slow deployment of an air bag when the child seat is present.

20 Claims, 5 Drawing Sheets





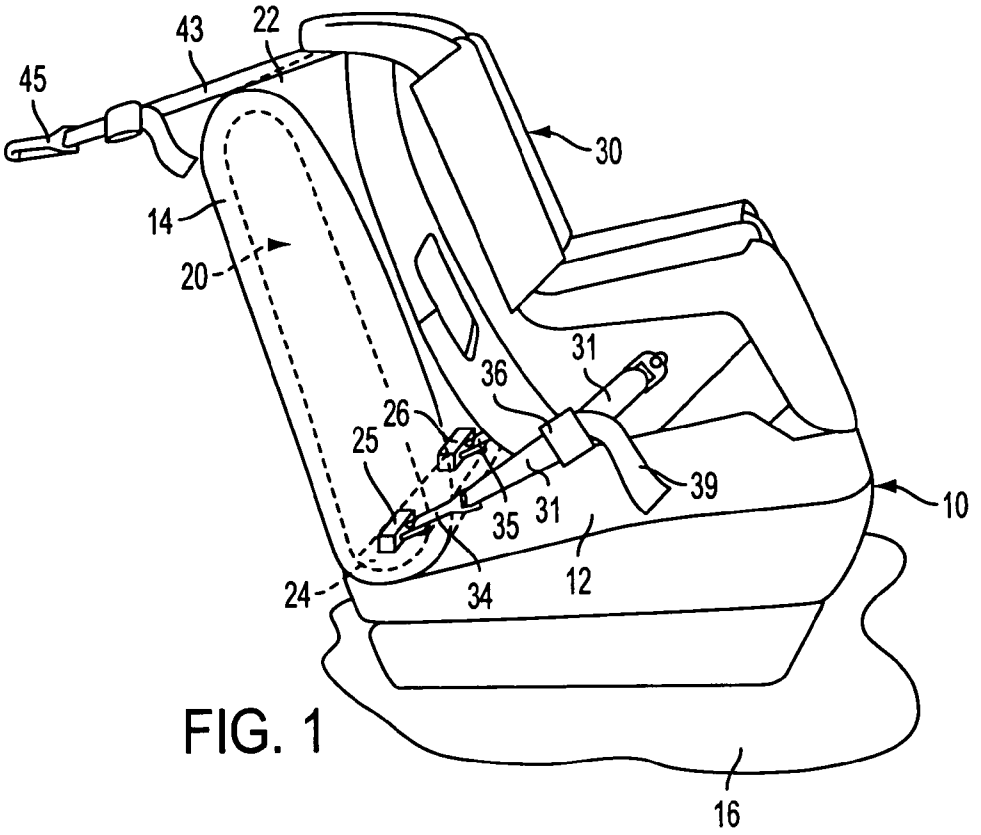

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FIG. 1

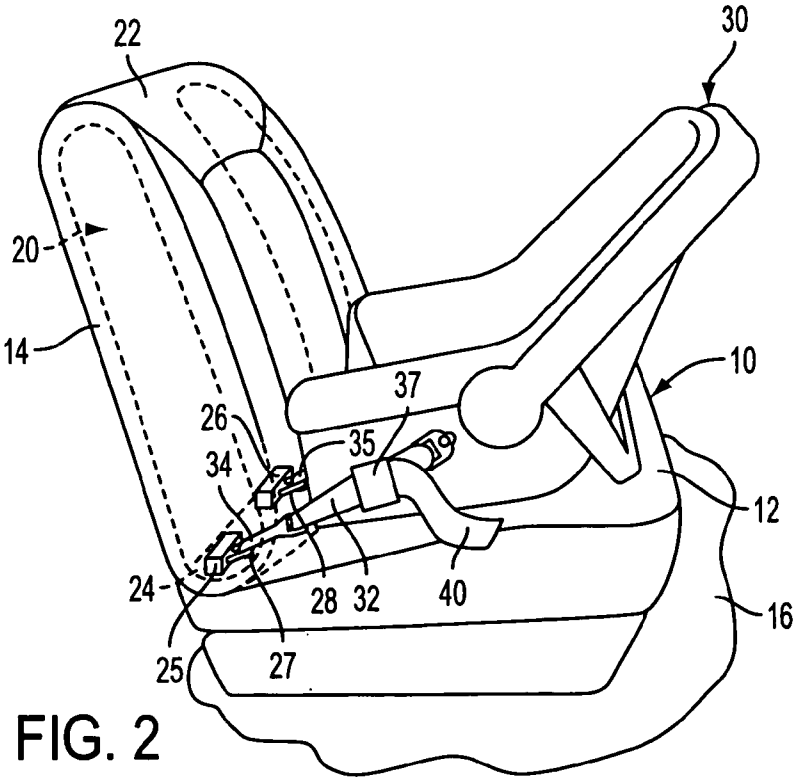
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FIG. 2

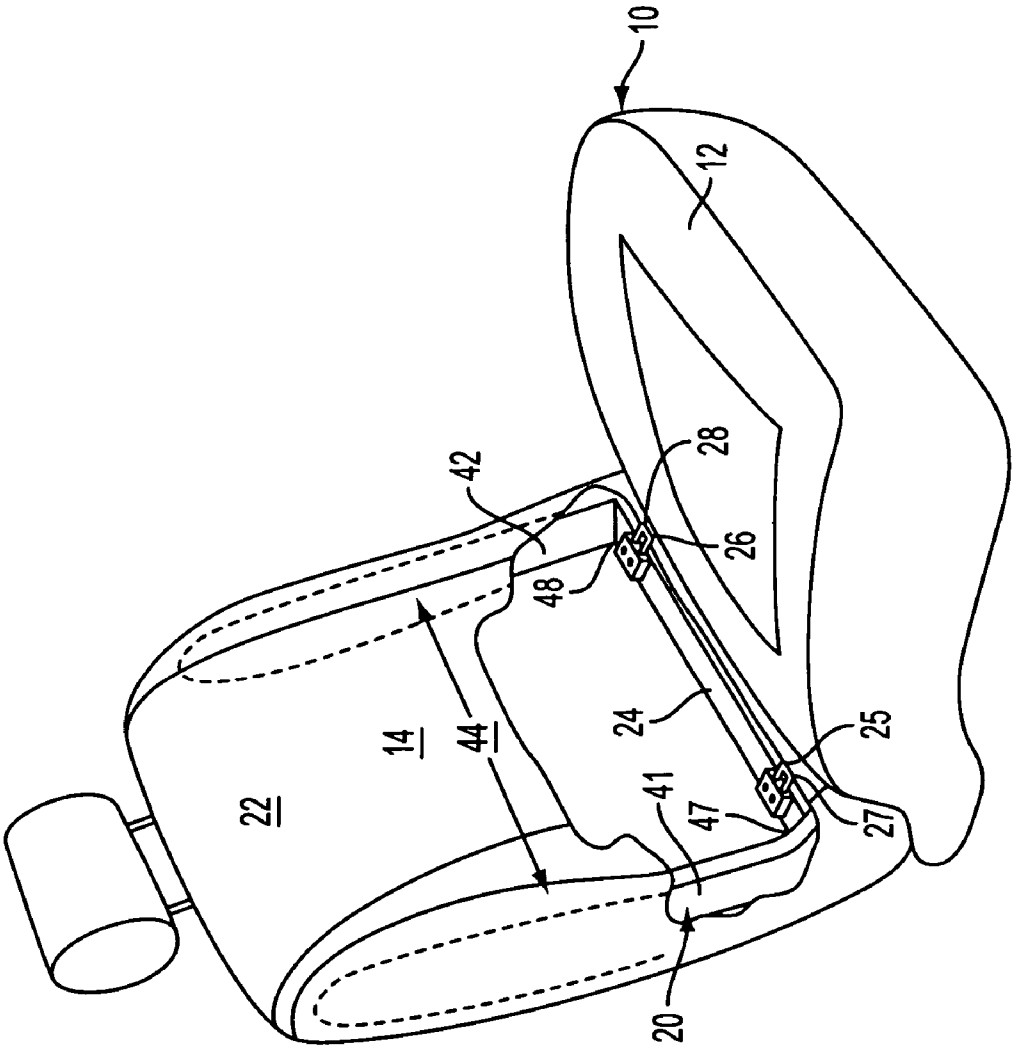
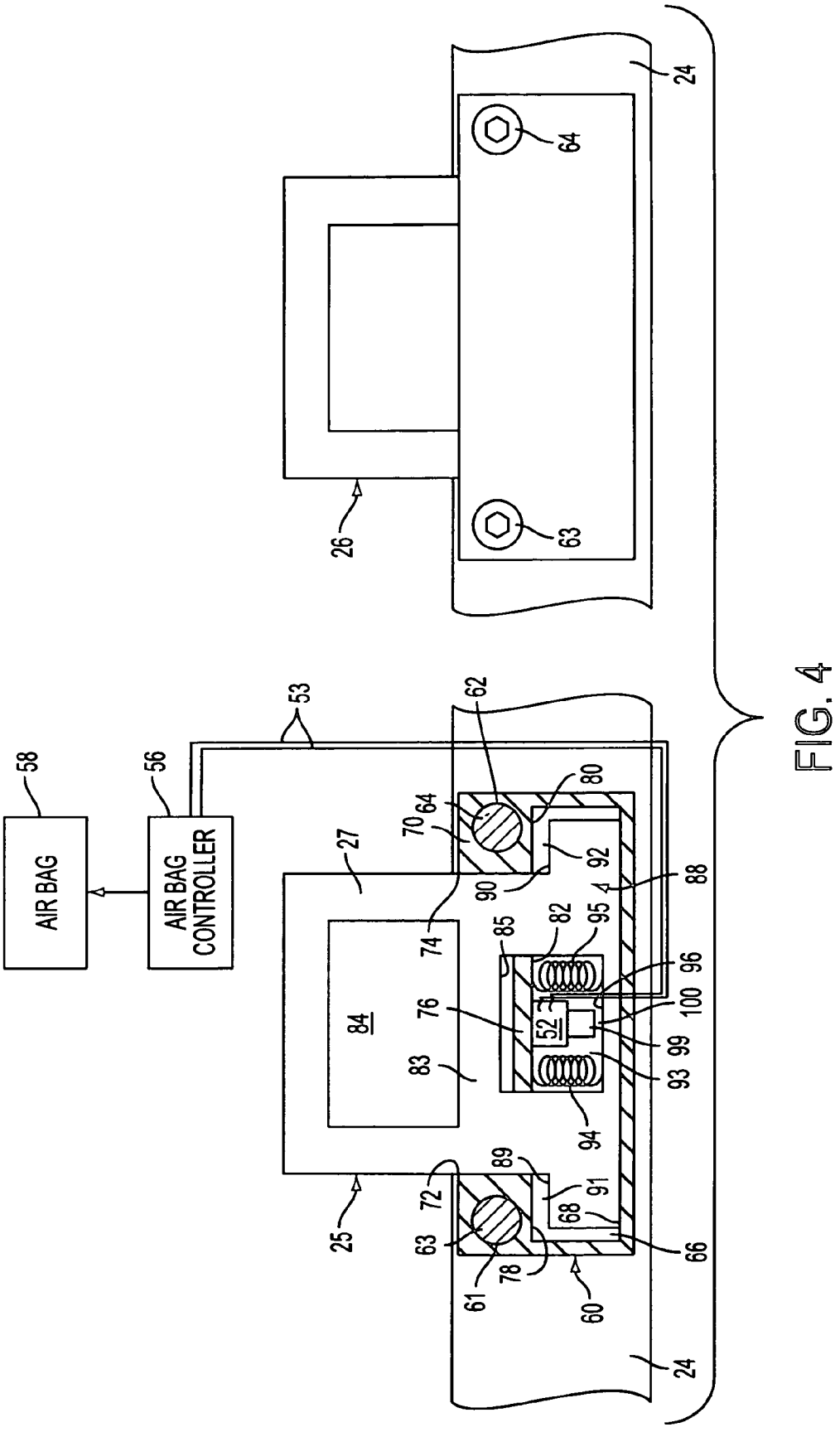


FIG. 3


AIR BAG
AIR BAG CONTROLLER
58
56
53
62
64
80
70
27
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74
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96
100
84
76
52
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FIG. 4

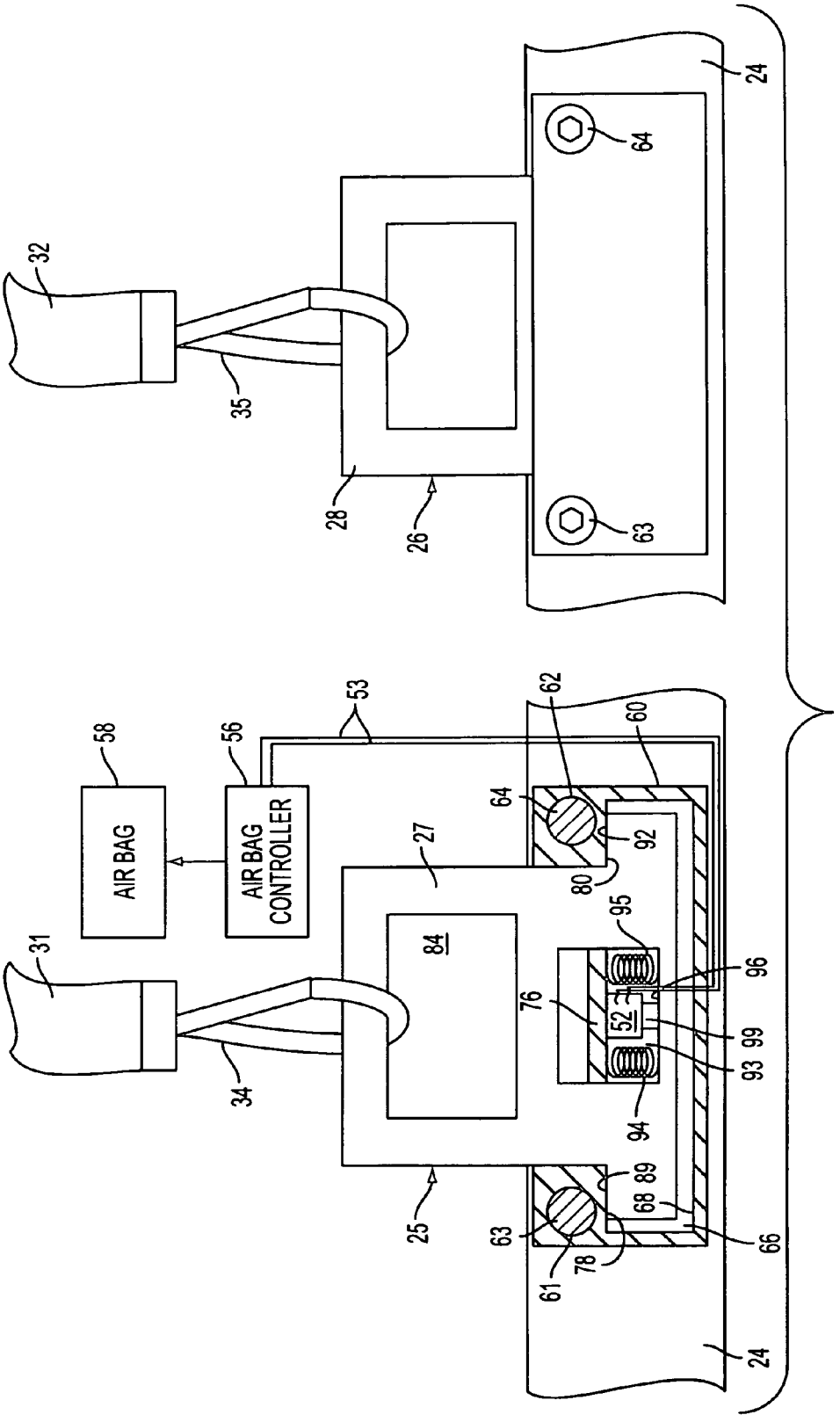
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FIG. 5

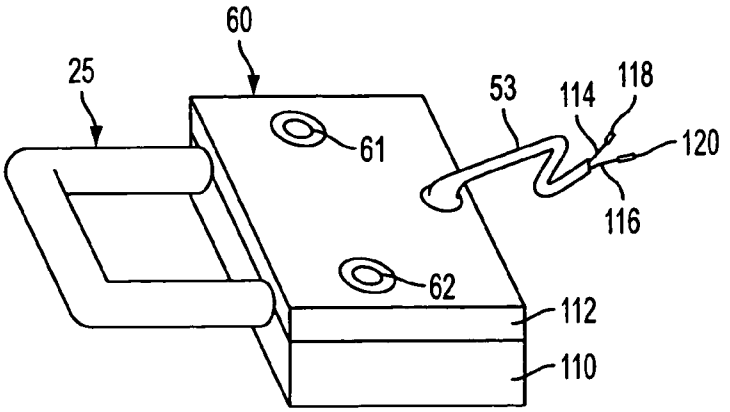

FIG. 6

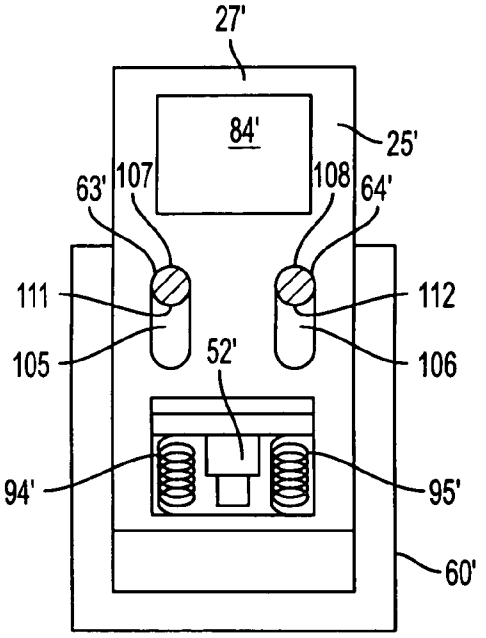

FIG. 7

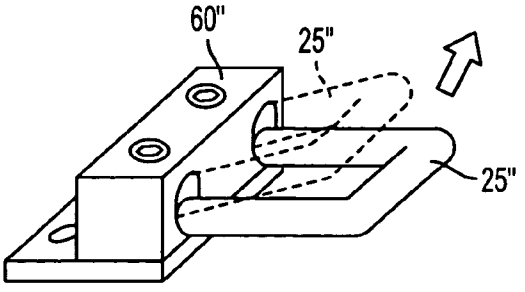

FIG. 8

CHILD RESTRAINT SEAT ANCHORS WITH INTEGRATED CHILD SEAT DETECTORS

FIELD OF THE INVENTION

The present invention is directed to child restraint seat anchors with integrated child seat detectors. More particularly, the present invention is directed to child restraint seat detection devices, which notify an air bag controller that a child restraint seat is present on a vehicle seat in order to either disable an air bag, or to slow the deployment speed of the air bag.

BACKGROUND OF THE INVENTION

A child being carried in a child restraint seat can be subjected to relatively high impact forces upon deployment of an air bag against the child, whether that air bag is a front air bag or a side curtain air bag. Accordingly, it is suggested that children beneath a selected size and weight not be subjected to impact by air bags. In some vehicles, manual switches are provided to deactivate air bag deployment systems when a child restraint seat is occupied by a child. A driver or passenger can forget to operate the manual switch when a child is seated, or the air bag can be left in a deactivated mode when an adult is seated.

This has led to arrangements for automatically deactivating air bags when the presence of a child rather than an adult in a vehicular seat is detected. Currently, these devices respond to the weight of a person occupying a front passenger seat, whether that person is an adult or a child, rather than responding to the mere presence of a child restraint seat. It has been found that some weight based suppression systems that are installed in the seat cushion of the right front passenger seats have difficulty correctly classifying "Lower Anchorage and Tether for Children" (LATCH) child restraint seats that are attached to the lower anchorages of the front passenger set. The reason for this difficulty is the inability of the suppression system to detect the amount of load being applied by the attached child restraint seat to the set cushion, which results in added weight measurement to the suppression system. This misclassification occurs when this added weight equals the amount of weight that an adult occupant would apply while seated in the right front passenger seat. It is not currently realized that the mere presence of a child restraint seat in almost all cases precludes occupancy of the passenger seat by an adult, who is less likely to experience ill effects from an air bag impact than an infant or small child. Accordingly, there is a need in systems, such as LATCH child restraint seat systems, for detection devices which recognize the mere presence of a child restraint seat and use that recognition to deactivate or alter deployment speeds of airbags.

SUMMARY OF THE INVENTION

The present invention is directed to an anchor device for child restraint seats that detects whether a child restraint seat is attached to a vehicle seat. The anchor device comprises a housing adapted to be fixed to the vehicle seat and a movable anchor having coupler and mounting portions, the coupler portion adapted to couple with a coupler on the child seat and the mounting portion being received in the housing. The movable anchor is shiftable within the housing from a first position, indicating that a child seat is not attached to the vehicle seat, to a second position indicating that a child seat is attached to the vehicle seat. At least one spring urges the movable anchor to the first position. A first stop is engaged by the movable anchor when the movable anchor is in the first position and a second stop is engageable by the movable anchor when the movable anchor has shifted to the second position. When engaged by the movable anchor, the second stop transfers force applied by the coupler of the child restraint seat to the vehicle seat. A switch is an operative association with the movable anchor and is adapted to connect to an air bag to disable deployment of the air bag, or reduce the speed of the air bag upon the movable anchor being moved to the second position, indicating presence of the child restraint seat.

In another aspect of the invention the movable anchor positively engages the second stop upon shifting to the second position.

In a further aspect of the invention, the switch is a normally open switch which is closed upon the movable anchor being shifted to the second position.

In still a further aspect of the invention the housing includes a chamber having an opening though a front wall, through which opening the coupler portion of the movable anchor extends. The chamber has a rear wall defining the first stop that is spaced a selected distance from the front wall, the front wall defining the second stop.

In another aspect, the invention is directed to an arrangement for attaching a child restraint seat to a frame of a seat back of a vehicle seat, wherein the arrangement comprises a pair of child seat anchors positioned in spaced relation to one another on the frame of the seat back. At least one of the anchors is a movable anchor disposed in a housing fixed to the seat back and being shiftable between a first position, indicating that a child seat is not attached, and a second position, indicating that a child seat is attached. At least one spring is disposed between the housing and the movable anchor for urging the movable anchor to the first position. A switch in operable association with the movable anchor is adapted for connection to an air bag to disable the deployment of the air bag or to modify deployment speed of the air bag upon the movable anchor being moved to the second position.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

FIG. **1** is a side view showing a forward facing child restraint seat attached to a front vehicle seat by utilizing a mounting anchor configured in accordance with the principles of the present invention;

FIG. **2** is a side view showing a rearwardly facing child restraint seat attached to a front vehicle seat by utilizing a mounting anchor configured in accordance with the principles of the present invention;

FIG. **3** is a perspective view, partially cut away, of a front vehicle seat modified in accordance with the principles of the present invention to anchor the child seats of FIGS. **1** and **2**;

FIG. **4** is a top view, partially in elevation, of a first embodiment of the invention illustrating the position of a movable anchor, prior to attaching the child seat thereto;

FIG. **5** is a view similar to FIG. **4**, but showing a position of the movable anchor after attachment to the child seat thereto;

FIG. **6** is an isolated perspective view of an unattached movable anchor configured according to the present invention;

FIG. **7** is a top elevation of a second embodiment of an anchor configured in accordance with the principles of the present invention, and

FIG. **8** is a perspective view of a third embodiment of an anchor configured in accordance with the principles of the present invention.

DETAILED DESCRIPTION

Referring now to FIGS. **1** and **2** there is shown a front vehicle seat **10** having a seat portion **12** and a back portion **14**. The back portion **14** is cantilevered to the seat portion **12** and the seat portion is anchored to the floor **16** of the vehicle. The back portion **14** has a rigid frame **20** therein which is covered by padding and upholstery **22**. Attached to the rigid frame **14** is a cross bar **24**, which has fixed thereto anchors **25** and **26** having coupling portions **27** and **28** to which a child restraint seat **30** is attached.

A child restraint seat **30** includes a pair of straps **31** and **32** thereon with hooked couplers **34** and **35**. The straps **31** and **32** have fittings **36** and **37** which allow the straps to be adjusted in length between the child restraint seat **30** and the hooked couplers **34** and **35** by pulling on ends **39** and **40** of the straps. Thus, when the child restraint seat **30** is attached by the hooked couplers **34** and **35** to the anchor loops **27** and **28** of the anchors **25** and **26**, and the ends **39** and **40** of the straps **31** and **32** are pulled, tension is applied to the straps and thus to the anchors **25** and **26**.

In the illustrated embodiment, the vehicle seat **10** is a right front passenger seat for American road vehicles or a left front passenger seat for vehicles such as UK road vehicles. The illustrated child restraint seat **30** is an existing configuration, however the principles of the present invention may apply to other child restraint seat configurations. Only if a vehicle air bag is disabled should one consider mounting a child restraint seat **30** facing rearwardly as shown in FIG. **2**. The arrangement according to the present invention increases the likelihood that air bags are in fact disabled. As is seen in FIG. **1**, if the child restraint seat **30** is facing forward, a tether **43** with a hook **45** is hooked into either an anchor on the back **14** of the seat **10** or fixed to the vehicle frame supporting the floor **16** at a location behind the seat anchors **25** and **26**.

Referring now to FIG. **3** it is seen that the seat back frame **20** comprises vertical frame members **41** and **42** which are laterally spaced from one another by a distance **44**. In accordance with a preferred embodiment of the present invention, the cross bar **24** which is part of the frame **20** extends between the frame members **41** and **42** at lower ends of the frame members and is fixed at opposite ends **47** and **48** thereto. The anchors **25** and **26**, to which the hooked couplers **34** and **35** of the child restraint seat **30** are attached via the anchor loops formed by the coupling portions **27** and **28**, are mounted on the cross bar **24** proximate the opposite ends **47** and **48** thereof. In accordance with the present invention, as the straps **31** and **32** are tightened by pulling the ends **39** and **40** of the straps, at least one of the anchors **25** or **26** move from a first position to a second position. The straps **31** and **32** need not be shortened if the straps are of a length to begin with that applies tension to the anchors **25** and **26** when the hooked couplers **34** and **35** are attached.

Referring now to FIGS. **4** and **5**, it is seen in a first embodiment of the invention tat at least one of the anchors, preferably the outboard anchor **25**, is an active anchor having a position sensor switch **52** therein which detects the presence of a child seat coupler hook **34** attached to its anchor loop **27**. Upon detecting the presence of the hooked coupler **34**, the position sensor switch **52** transmits a signal over a line **53** to an air bag controller circuit **56** that either disables an air bag **58** or reduces the inflation speed of the air bag. The sensor switch **52** only detects the presence of a child restraint seat **30** and thus operates independently of the presence of an occupant in the child seat.

The active anchor **25**, illustrated in FIGS. **4** and **5**, represents a preferred embodiment of an active anchor, wherein a housing **60** having a pair of bolt holes **61** and **62** is secured to the cross beam **24** of the vehicle seat back **14** by bolts **63** and **64** which pass through the bolt holes **61** and **62**. The housing **60** has a chamber **66** therein having a rear wall **68** and a front wall **70**. The front wall **70** has a pair of openings **72** and **74** therethrough which are separated by a front wall portion **76**. The front wall **70** defines a pair of shoulders **78** and **80** while the front wall portion **76** has a reduced thickness and an internally facing surface **82**. While only the movable anchor **25** is shown as active, the anchor **26** could also be made active by having the configuration of movable anchor **25**.

The coupling portion **27** of the movable anchor **25**, which is in the form of a loop, projects through the openings **72** and **74** in the front wall **70** and has a cross bar **83** which defines the back surface of an opening **84** forming the loop of the coupling portion. The cross bar **83** also has a rear surface **85**, which is preferably spaced from the intermediate wall portion **76**.

Extending through the openings **72** and **74** and the front wall **70** is a mounting portion **88** of the movable anchor **25**. The mounting portion **88** has a pair of laterally projecting shoulders **89** and **90** positioned opposite the stop surfaces **78** and **80**, respectively, which are spaced by gaps **91** and **92** from the shoulders **89** and **90**, respectively.

The mounting portion **88** of the movable lug **25** has a recess **93** therein which receives the intermediate wall portion **76**, a pair of coil springs **94** and **95**, as well as the switch **52**. The coil springs **94** and **95** bear against a rear wall **96** of the recess **93** and against the rear surface **82** of the intermediate portion **76** of front wall **70**.

As is further seen in FIG. **4**, since the coil springs **94** and **95** are under compression, the coil springs push the mounting portion **88**, and thus the movable anchor **25**, back into engagement with the rear wall **68** of the housing **60**. The springs **94** and **95** are under sufficient compression so that it takes 8 to 15 pounds of force to move the movable anchor **25** against the bias of the springs. Preferably, this force is about 10 pounds. Thus, an impact against the vehicle in which the movable anchor **25** is employed, does not generate sufficient force to overcome the compressive force of the springs **94** and **95**. Consequently, the springs **94** and **95** will hold the movable anchor **25** in the first position of FIG. **4** during an impact.

While in the first position, the shoulders **89** and **90** are separated from the front wall stop surfaces **78** and **80** by the gaps **91** and **92**, while an actuator **99** of the micro switch **52** is spaced from the rear wall **96** of the recess **93** by a second gap **100**. The second gap **100** is narrower than the first gaps **91** and **92** so that when the movable lug **25** moves from the first position of FIG. **4** to the second position of FIG. **5**, the rear wall **96** of the recess **93** contacts and pushes the actuator **99** of the switch **52** prior to the shoulders **89** and **90** abutting the stop surface walls **78** and **80**. This ensures that the switch **52** is actuated when the movable anchor **25** is shifted to the second position. The gaps **97** and **98** are in the range of 1 to

4 mm, preferably about 2 mm; while the gap **100** between the actuator **99** and rear wall **96** of the recess **93** is preferably about 1 mm or less.

As is seen in FIG. **5**, upon attaching the hooked couplers **34** and **35** to the anchors **25** and **26** and tensioning at least the strap **31**, the movable anchor **25** moves from the FIG. **4** position to the FIG. **5** position where the switch **52** is actuated while the shoulders **89** and **90** abut the stop walls **78** and **80**. Since the switch **52** operates the air bag controller **56** to disable deployment of the air bag **58**, and the movable anchor **25** is now pressed positively against the first stop surfaces **78** and **80**, an impact will transfer force from the seat **30** through the strap **31** and hooked coupling **34** to the movable anchor **25**. The movable anchor **25** bears against the housing **60** that is anchored to the cross beam **24** in the seat back frame **20**. Thus, the child restraint seat **30** and child therein are restrained without deployment or with reduced speed deployment of the air bag **58**.

In the preferred embodiment the micro switch **52** in a first state is normally "off", i.e., is off in the position of FIG. **4**, so that it does not continuously draw current when the child restraint seat **30** is not attached to the vehicle seat. The decision to configure micro switch as normally "off" instead of normally "on" in a first state is based on the likelihood that the child seat **30** will not be attached to the front seat **10** for the majority of the time the vehicle is used. Consequently, it is in accordance with the principles of the present invention to have the micro switch **52** normally open or "off" and only closed or "on" when the child restraint seat **30** is mounted on the vehicle seat **10** and attached to at least the movable anchor **25** to move the switch to a second state.

The micro switch **52** is preferably arranged in a micro switch assembly, which assembly includes two resistors used for diagnostics in proximity with the micro switch. For example, a resistor of 100 ohms is placed in series with a movable contact within a micro switch **52** while a 1 K resistor is in parallel with the contact. The micro switch **52** can be mechanical, resistive, magnetic, strain sensing, capacitive or any other type of switch effective for the disclosed purpose of closing or opening in response to attachment of the hooked coupler **34** to the movable anchor **25**.

As is seen in FIG. **6**, the movable anchor **25** is a modular unit with a base **110** and a cover **112**. The line **53** to the air bag controller **56** (FIGS. **4** and **5**) is configured as a pair of leads **114** and **116** having electrical connectors **118** and **120** that couple with long leads (not shown) from the air bag controller **56**. By configuring the movable anchor **25** as a modular unit, incorporation of the movable anchor **25** in existing designs for vehicle seats is facilitated.

Referring now to FIG. **7**, while the configuration of FIGS. **4** and **5** is preferred, the movable anchor **25'** may have other configurations such as that of FIG. **7** in which the bolts **63'** and **64'** are received in slots **105** and **106** disposed in the mounting portion **88'** of the movable anchor. In this configuration, first side surfaces **107** and **108** of the bolts **63'** and **64'** provide the first stop surfaces for the movable anchor **25'**, while second side surfaces **111** and **112** of the bolts **63'** and **64'** provide second stop surfaces for the movable anchor **25'**. This is because the coil springs **94'** and **95'** urge the movable anchor **25'** in a direction into the housing **60'**.

Referring now to FIG. **8**, there is shown another embodiment of the invention wherein a movable anchor **25"** pivots from a first position, in which the child seat **30** is not attached to the movable anchor, to a second position (dotted lines) in which the movable anchor **25"** is lifted upon coupling the hooked coupler **34** of the child seat thereto. In the arrangement of FIG. **8**, the movable anchor **25"** is biased to the first solid line position and pivots against the bias of a spring to the dotted line position, the pivoting motion operating a position sensing switch within the housing **60"** that disables the air bag.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing form the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.

We claim:

1. A child restraint seat anchor device that detects independent of the presence of a seat occupant whether a child restraint seat is attached to a vehicle seat, the child restraint seat anchor device comprising:

a housing adapted to be fixed to the vehicle seat;

a movable anchor having a coupler portion and mounting portion, the coupler portion being adapted to couple with a coupler on the child restraint seat and the mounting portion being received in the housing; the moveable anchor being shiftable within the housing from a first position, indicating that a child seat is not attached to the vehicle seat, to a second position, indicating that a child seat is attached to the vehicle seat;

at least one spring applying a bias to the movable anchor to urge the movable anchor to the first position;

a stop engaged by the movable anchor when the movable anchor has shifted to the second position, when engaged by the movable anchor the stop transferring force applied by the coupler of the child restraint seat to the vehicle seat, and

a switch in operative association with the movable anchor and operable independent of a seat occupant, the switch having a first and a second state and being adapted for connection to an air bag to disable deployment of the air bag or to reduce deployment speed of the air bag only when in the second state upon the movable anchor being shifted to the second position, and the switch allowing deployment of the air bag at normal speed when in the first state while the movable anchor is in the first position.

2. The device of claim **1**, wherein the movable anchor positively engages the stop upon shifting to the second position.

3. The device of claim **2** wherein the switch is a normally open switch which is closed upon the movable anchor being shifted to the second position.

4. The device of claim **3** wherein the switch is a micro switch having an actuator spaced from the movable anchor when the movable anchor is in the first position and engaged by the movable anchor when the movable anchor has shifted to the second position.

5. The device of claim **1** wherein the housing includes a chamber having an opening through a front wall thereof which the coupler portion of the movable anchor extends, the chamber receiving the mounting portion of the movable anchor, the chamber having a rear wall defining the first stop that is spaced a selected distance from a front wall, which front wall defines the second stop.

6. The device of claim **5** wherein the mounting portion of the movable anchor includes shoulder portions which engage the front wall adjacent to the opening through which the coupling portion of the movable anchor extends.

7. The device of claim **6** wherein the mounting portion of the movable anchor includes a recess therein in which the at least one spring and the micro switch are positioned.

8. The device of claim 7 wherein the at least spring has a first end abutting a portion of the front wall of the housing disposed within the recess and a second end engageable by a rear wall of the recess in the movable anchor.

9. The device of claim 8 wherein there are two springs with the micro switch positioned therebetween.

10. The device of claim 9 including bolt holes through the front wall adapted to receive bolts for fixing the device to a vehicle seat.

11. The arrangement of claim 1 wherein the switch has only a first state and a second state.

12. The arrangement of claim 1 wherein the anchor is independent of a seat belt or seat belt anchor.

13. An arrangement for attaching a child restraint seat to the frame of a seat back of a vehicle seat, the arrangement comprising:

a pair of child restraint seat anchors positioned in spaced relation to one another on the frame of the seat back, at least one of the anchors being a movable anchor disposed in a housing fixed to the seat back and being shiftable between a first position, indicating that the child seat is not attached, and a second position indicating that a child seat is attached;

at least one spring disposed between a wall of the housing and the movable anchor for urging the movable anchor to the first position;

a first stop within the housing engaged by the movable anchor when the movable anchor is in the first position;

a second stop within the housing engageable by the movable anchor when the movable anchor has shifted to the second position, when engaged by the movable anchor, the second stop transferring force applied by the coupler of the child restraint seat to the vehicle seat, and

a switch in operable association with the movable anchor and operable independent of the presence of a seat occupant, the switch having a first state and a second state and being adapted for connection to an air bag to disenable deployment of the air bag or to decrease deployment speed of the air bag only when in the second state upon the movable anchor being moved to the second position, the switch allowing deployment of the air bag at normal speed when in the first state while the movable anchor is in the first position.

14. The arrangement of claim 13 wherein the switch is a normally open electrical switch.

15. The arrangement of claim 14 wherein the switch is within the housing.

16. The arrangement of claim 13 wherein the second stop is positively engaged by the movable anchor when the movable anchor is moved to the second position by attachment of the child restraint seat to the movable anchor.

17. The arrangement of claim 13 wherein the movable anchor is slidably mounted for sliding between the first and second positions.

18. The arrangement of claim 13 wherein the movable anchor is pivotably mounted for pivoting between the first and second positions.

19. The arrangement of claim 13 wherein the switch has only a first state and a second state.

20. The arrangement of claim 19 wherein the child seat is secured to the vehicle seat independently of a seat belt and seat belt anchor.

* * * * *